Air Force Research Laboratory|AFRL

Science and Technology for Tomorrow's Air and Space Force

Air Force SBIR/STTR

Success Story

HIGH-FREQUENCY ACOUSTIC SYSTEM

Scientists created the High-Frequency Acoustic Suppression Technology (HiFAST) airflow control device to replace the spoilers traditionally used to reduce acoustic resonance created by opening weapons bay doors at high speeds. HiFAST is a second-generation device that requires less flow than the first-generation, active separation control device. By injecting air through nozzles at the front of an aircraft's weapons bay, the HiFAST device effectively reduces weapons bay acoustics and aids in safe weapons separation without using any moving parts or extending past the surface of the air vehicle.

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Accomplishment

AFRL successfully completed the first flight test of the HiFAST flow control device under a cooperative research effort between Australia and the US. For the flight test, engineers fitted HiFAST onto a Royal Australian Air Force F-111. While the F-111 flew at subsonic, transonic, and supersonic speeds, scientists collected acoustic, thermal, and vibration data from instrumentation placed throughout the aircraft's weapons bay. Additionally, the team collected data during release of the Powered Low-Cost Autonomous Attack System subpack munitions, also developed by AFRL.

Throughout testing, HiFAST successfully reduced the acoustic noise levels in the open weapons bay. The Small Business Innovation Research program funded AFRL to reduce the aeroacoustic loads in the weapons bay environment.

Background

The HiFAST device is located within the leading edge of the aircraft weapons bay and can be controlled by the flight engineer or pilot during flight. It contains nozzles that inject the airstream with pulses of supersonic high-pressure air, which counters airflow instabilities generated by opening a weapons bay door. Without HiFAST, opening weapons bay doors during flight creates a highly unstable shear layer—an area where airflow transitions sharply from the high-speed airflow outside the weapons bay to slower-speed airflow within the bay. This condition results in unstable pockets of circularly rotating air, called vortices, which hit the weapons bay walls and generate acoustic waves. These acoustic waves flow back up the airstream and cause acoustic resonance, which produces strong vibrations that may damage the aircraft, its systems, and the weapons it carries.

Air Vehicles
Support to the Warfighter

Additional Information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (05-VA-04)